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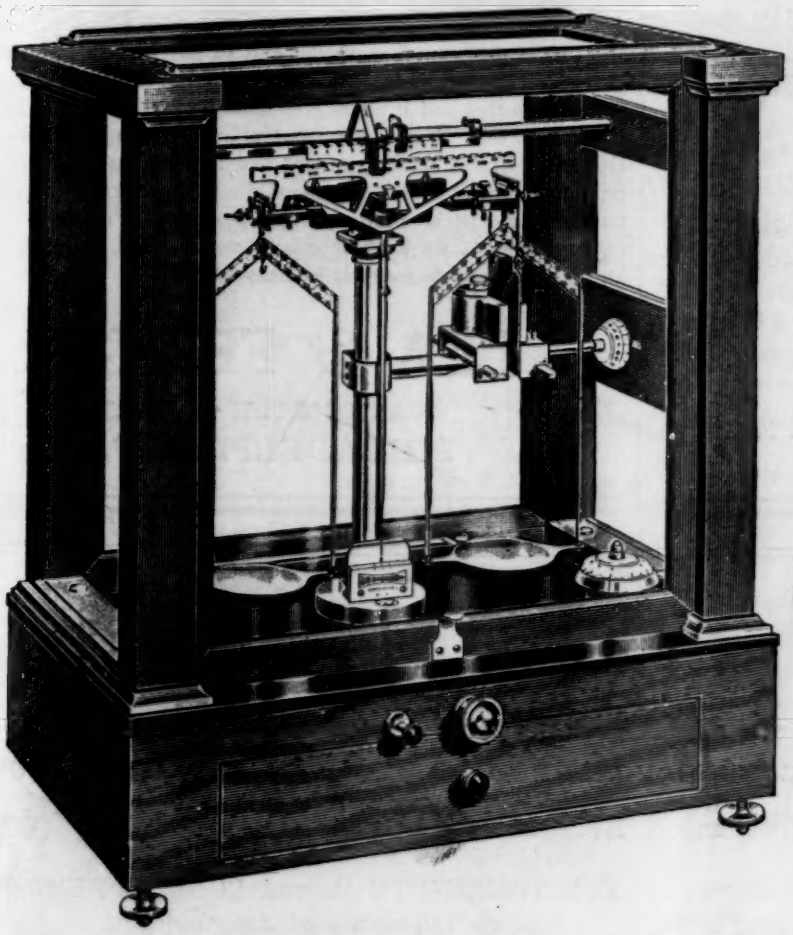

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METHODS OF APPROACH IN TEACHING TAXONOMY[1]

By Professor K. M. WIEGAND

NEW YORK STATE COLLEGE OF AGRICULTURE, CORNELL UNIVERSITY

SOME years ago a questionnaire addressed to taxonomists, plant workers and educators indicated quite clearly a belief that there exists at present a dearth of taxonomists, of taxonomic teaching and also a lack of appreciation of the subject. While the replies to these questionnaires easily indicated the need for taxonomy in the various fields of plant study, and in biology in general, the reasons for the apparent failure of the subject were not so apparent. In fact, many reasons were given and with varying emphasis. I was at that time a member of the committee issuing the questionnaire and have been much interested in the matter ever since.

[1] Read before the Systematic Section of the Botanical Society of America at Pittsburgh, December, 1934.

It is undeniable that taxonomy has been unpopular for the last several decades. Among the many contributory reasons often mentioned are the following: (1) Lack of available instruction; (2) deficiencies in type of instruction; (3) lack of openings for employment in the profession; (4) lack of well-paying positions as an ultimate goal; (5) dearth of students with a "taxonomic mind"; (6) reputation of taxonomy as an unimportant branch of botany; (7) lack of appreciation of one's taxonomic work by others; (8) lack of sympathy with the unstable condition of nomenclature and group limits; (9) difficulty of pursuing taxonomy away from taxonomic centers; (10) a more detailed training to become a good teacher of taxonomy than is necessary in other branches of botany. These

reasons are varied enough to suit any one. When boiled down they mostly lead to a single one, a lack of appreciation of the importance of taxonomy. This, however, seems to be an incorrect view-point if we judge from the replies to the questionnaire that were received from every branch of so-called "applied" botany—agronomy, pomology, vegetable gardening, forestry, horticulture, plant breeding, plant pathology, etc., and also from persons interested in general culture.

There is no doubt that the general upheaval in nomenclature has reacted unfavorably on the popularity of taxonomy. Those who can not see in this a step in the transition to a more accurate and scientific nomenclature, and most non-taxonomists can not, must necessarily be prejudiced by the apparent wanton activities of the nomenclatorialists. Likewise the widely divergent practices concerning group limits have reacted unfavorably on the non-taxonomist. The "splitters" and "lumpers" certainly have had something to do with dampening the enthusiasm of the student.

But a more important reason is historical. Taxonomy was the earliest phase of botany to receive development. Until about 1890, in this country, it was almost the only phase to receive attention. Then came to the front physiology, morphology and particularly ecology, each representing a very interesting and important mass of new information about plants and, what is more important, presenting new points of view. These fields became at once popular. The pendulum swung to the opposite extreme, taxonomy was taboo. The old botany was looked upon as trivial, unimportant and dealing with the dry-bones of plants. The taxonomist lost caste and indeed had difficulty in maintaining his own self-respect. Like most cases of this sort the pendulum swung too far. Its correct position when at rest should be somewhere between the two extremes. It is now apparently in the process of swinging back to this mean, but as yet the movement has not gone far, though the swing has undoubtedly begun.

But another factor is playing an important part in helping to create the erroneous evaluation of taxonomy, namely, a wrong understanding of what this branch of botany really includes. A very common impression, expressed in varying detail, is that it concerns simply the classification of objects, in this case chiefly dead plants. The taxonomist, it is said, is continually shifting dried plants around first into one category, then another, after the manner of a picture puzzle or a game of solitaire, largely for self-entertainment and with no important objective. When not shifting plants he shifts names for amusement, having developed in connection with his plant nomenclature a new and entertaining, though at times difficult, game. So engrossed does he seem to have become in his various games of change that the layman is willing and glad to leave him alone. I was not a little disturbed in a recent scientific meeting at a statement made by a certain speaker to the effect that in certain genetical studies he was getting minor peculiarities which, though of much real importance, were not of interest to the taxonomist who must necessarily be concerned with putting his plants in categories, and these variations did not readily fall into categories and therefore had no place in taxonomy, so that the taxonomist, not knowing what to do with them, was inclined to ignore them entirely. I was all the more disturbed since as a taxonomist over a considerable number of years I have never looked at taxonomy in this way. It is my belief also that by far the greater number of taxonomists of note have not had this point of view. At the end of each genus in our herbarium is a cover in which unusual specimens are placed that differ from the regular run of specimens for the various species. These specimens are often considered the most interesting in the whole genus, as they bring up problems in variation which are baffling as to origin and significance. Teachers of taxonomy are not wholly without blame for the distorted view-point. Apparently because of the general over-emphasis on classification, many teachers have built their courses around the present accepted classification, often with little emphasis on plants as living objects. Such courses are frequently very dry indeed.

This erroneous impression of taxonomy is doubtless due in no small part also to the two names, taxonomy and systematic botany, which have been applied to it. Originated by the early botanists who were impressed with the need for an orderly arrangement of the growing number of known plants these terms have persisted almost unchallenged, though they represent but one feature of the subject. It can not be too strongly emphasized that in this field of botany we are concerned not simply with classification but with a knowledge of the kinds of plants, their habits and peculiarities. We are concerned with a knowledge of similarities, differences, blood relationship, variation under environmental changes, genetic behavior, adaptability, environmental requirements of light, soil, etc., associations, geographical distribution and geological history. We are concerned, in fact, with knowing plants as living organisms. To be sure, the similarities, differences and relationship between individuals of any large group of objects are best made apparent through classification, but the classification is not the end sought. It is only a means to a better understanding of the kinds of objects concerned. Nomenclature, too, is only to supply us with convenient

and useful handles in dealing with plants. In human society a primitive desire of the individual, and also a very useful desire, is to know his associates. He is not concerned primarily with classifying his fellows, but desires rather to know their trade, family history, personal peculiarities and experience—and their names too as a means of identification and reference. To be sure, he soon unconsciously classifies—for he thinks of people in categories—the various trades and professions, people of various mental traits, and the like, but here again the classification is simply to aid him to a better grasp of the peculiarities of the individual. We often ask the question: "Do you know Mr. X?" And the reply frequently is, "Not really, I know him by sight only"; which implies that we unconsciously assume that "knowing a person" means more than simply the ability to call him by name. Knowing plants likewise means much more than the ability to call them by name. Looked at in this light, knowing the kinds of plants becomes very fundamental, and is both broad and deep. Thus it is too in industry. A contractor is supposed to know his materials, so also is an engineer or an architect. This does not mean the ability simply to call an object by name, but also to know its properties and how it will behave under different conditions. Why, then, should not a botanist know his materials?

The real taxonomist then, as I see it, is not interested primarily in classification or in nomenclature. He is interested in *knowing plants,* in knowing the kinds of plants.

It is very unfortunate that we possess no name for this branch of botany when viewed so broadly. A suitable term would greatly help to set us right. Professor L. H. Bailey has indeed, in designating his recently published series of papers, spoken of these as essays on the "kinds of plants," and has employed the Latin expression "gentes herbarum"; but the Latin word "gens," though otherwise fairly appropriate, has been used in so many modified ways that its use again would be very confusing. There is, however, one other Latin word that indirectly signifies race or kind, and which was used frequently by the older botanists in this sense, namely, *stirps.* This word too is easily combined with *logos,* making the word stirpology.

Stirpology then becomes the science of knowing the kinds of plants. While the beginner would not be expected to make use of much technical knowledge contained in the various scientific phases of botany with which he may not yet be acquainted, this would not be true of the specialist. He would make use of taxonomy, for the vast number of kinds of plants must be classified in order to be understood, as would be necessary with a very large number of any objects. He would also make use of phylogeny, geography, physiology, morphology, anatomy, embryology, cytology, genetics, ecology and all other angles from which plants may be viewed. Stirpology would not displace any of these phases of plant study, but simply shift the emphasis from the subject in the abstract (as for instance physiology), to its application to the individual at hand. A stirpologist would have before him a certain individual plant. He would view this as a living individual to be known from all points of view. He would be interested in its function, its structure, its history, its adjustments to its environment; but first of all he would desire to know its name and its place in the scheme of things with reference to its relatives, facts contributed by taxonomy and phylogeny.

Thus viewed, it seems to me stirpology becomes a very important and fundamental phase in the study of plants. Most of our so-called taxonomists, I believe, are more or less definitely stirpologists, not concerned with classification alone, though some may be that narrow. I present this new term with much hesitation, as our science is full of terms already, but it does seem to me to be a term very much needed.

But this is not all. The taxonomist's method of approach, as well as his view-point, has been criticized. It is quite necessary to make the subject a living one, clearly demonstrating both its practical and scientific value. Classification, nomenclature and similar formal features should not be over-emphasized, but rather should be presented as an aid in understanding the plants themselves. The view-point of knowing plants as completely as possible should be kept constantly in the foreground.

But as I see it there is another problem connected with the question of approach. One school apparently holds that greatest interest among students is created by a course in which comparative morphology, phylogeny and general classification are stressed, with group identity, nomenclature and species identification reduced to a minimum, thus giving the student a view of the value and scope of the subject as a science. The other school would proceed "psychologically," following as nearly as possible the natural sequence by which the individual acquires knowledge of a group of objects as he proceeds from childhood to maturity. It is suggested that in such ontogenetic development a person first recognizes individuals, then species, and only later, larger groups and broad generalizations. Usually his is first-hand knowledge arising from a familiarity with the actual objects, and not abstract information about them. As applied to taxonomy it would mean the stressing first of field work and identification, with information about the plants, such as habit, habitat, uses, etc., while only later would gen-

eralizations regarding relationship, group limits and classification be stressed. Where time is not restrictive, two courses, one introducing the student to the subject after the second plan, followed by a more advanced course emphasizing morphology, phylogeny, the broader groups and relationships, would seem ideal. It will probably be found that many of those advocating the first method really received their own initial interest through the second method, often in pre-college days.

The replies to our questionnaire also indicated a conviction that the psychologically proper time to interest youth in taxonomy is between the ages of 10 and 15 years. During that period young people are strongly interested in knowing things, and the collecting instinct, too, is strong. Later this interest wanes, to be replaced by more philosophical, abstract, emotional and idealistic interests. An interest in plants aroused in childhood often becomes permanent and intensified in later life. It was noted that a majority of the leading taxonomists had their introduction to the subject during this early period. The study of taxonomy should begin therefore in the upper grades and in high school. In scouting, particularly, there is an opportunity to begin the study under the most favorable conditions of outdoor programs, in summer when plants are growing. It is clear that if instruction is given at this period it must be after the second method.

In some respects I have seemed perhaps to have painted a rather gloomy view of taxonomy. While undoubtedly many of these points are serious ones, the outlook is not too dark. A spirit of optimism is found among most of those interested in the subject. The appreciation of taxonomy has greatly improved in many of our colleges. Classes show increased enrolment, and there is some indication of an increased demand for teachers. We are on the verge of an awakening, I think, to the importance of taxonomy in practical and cultural training.

OBITUARY

CHARLES LORING JACKSON[1]

BY the death on October 31, 1935, of Charles Loring Jackson, Erving professor of chemistry, emeritus, in Harvard University, American chemistry has lost one of the pioneers in chemical education and research in this country. At the time of his death he was the oldest as well as the senior officer in the university. He was born in Boston, Massachusetts, on April 4, 1847, and was a lifelong resident of that city. The son of Patrick Tracy Jackson, 2nd, a cotton manufacturer and merchant, and Susan Mary Loring, on both sides he was descended from long lines of distinguished Massachusetts citizens.

His preparation for college was obtained in private schools. In college he elected all the meager offering in chemistry of that time, and after graduation in 1867 became lecture assistant, with free tuition as his recompense, to Professor J. P. Cooke, who was still engaged in his single-handed struggle to create a chemistry department in the college. In April of the next year he was appointed "regular" assistant in chemistry, with the stipulation that Professor Cooke was to "teach him to be a chemist." Although he held this position for three years, and then, at the age of twenty-four, was appointed assistant professor, this arrangement did not entirely fulfil its promise. His time was largely occupied in teaching and running Cooke's elective course in qualitative analysis, the only course in chemistry with laboratory work at that time. In addition he served as storekeeper, "giving out the apparatus and keeping the accounts," and also to a considerable extent as janitor, "making up the reagents, filling the bottles and keeping them in order," so that his opportunities for study were restricted to odd moments which he could seize between duties. Weakened by an attack of rheumatic fever, in 1873 he decided to take a year's leave of absence for study in Europe. There at first he studied inorganic chemistry and inorganic analysis under Bunsen at Heidelberg, then organic chemistry under Hofmann at Berlin. This was a most important period in his career, for although he had never studied organic chemistry before, in a short time, as he himself states, he "lost his heart to organic chemistry and was ever after faithful to this love." The decision to devote himself to investigation in this subject resulted in his spending the following year in Berlin under Hofmann, and when he returned to Cambridge in 1875 he had the fine record of eight published papers to his credit.

In 1881 Jackson was promoted to a full professorship and from 1897 to 1912, when he resigned because of ill health, he was Erving professor of chemistry. From 1894 to 1903 he was chairman of the division of chemistry. During nearly all his service in the university he was a proctor, residing in Gray's 5 from 1868 to 1871 and in Holworthy 11 from 1871 to 1918.

As a teacher Professor Jackson is associated almost entirely with Chemistry 1. This was the first course in descriptive inorganic chemistry involving systematic individual laboratory practice for the students to be offered in Harvard College. He gave the course

[1] Minute on the life and services of Charles L. Jackson presented to the Faculty of Arts and Sciences of Harvard University.

for the first time in 1870–71 and very shortly adopted an order of presentation of material which was quite different from that almost universally employed both then and now. Instead of dealing at the beginning with the more difficult non-metallic elements, the less difficult metallic elements, commencing with the alkali metals, were considered. As soon as an adequate background had been formed the Periodic Classification was introduced, followed by the consideration of the metallic elements of varying valence and finally the non-metallic elements, with especial consideration of their positions in the Periodic Table. Much attention was paid to the applications of chemistry to everyday life, many technical processes being described in considerable detail. He believed thoroughly in the Socratic method of teaching and used it as far as possible both in his lectures and in the laboratory, where the class spent fully as much time as at the present day. A particularly valuable part of the laboratory work consisted of individual problems assigned toward the close of the course.

The unusual method of presentation which he followed during all the nearly forty years he gave this course was highly successful and amply justified his contention that it maintained the interest of the students more steadily than the conventional method. It may be that this method would not have been so successful in less competent hands, for Jackson not only was a great teacher but spared no effort to make his teaching a success. The fascinating picture of chemistry and its relation to natural processes and the developments of civilization presented by Chemistry 1 made it one of the most popular of college courses, besides providing a secure basis for future study of the subject.

Although research in organic chemistry was in its infancy in America at the time of his return from Europe in 1875, Jackson immediately commenced to investigate on his own account, and within a short time had prepared the first organic substance discovered in the laboratory of Harvard College, parabrombenzylbromide. He writes, "When I saw the crystals coming, I danced about the laboratory, as this was the first proof that Hill or I could do original work without a master." The study of the properties of this substance led to that of the preparation and properties of many other halogen substitution products of aromatic hydrocarbons and throughout his life investigations in this field remained his major experimental interest. This work resulted in the discovery that compounds in which the halogen is normally chemically inactive can be made available for synthetic work by the introduction of nitro groups, a discovery which has been of very great importance in the development of the chemistry of aromatic compounds. In later years his attention was directed to the study of the halogen substitution products of the quinones. In this field the knowledge acquired in the earlier investigations and his experimental skill enabled him to develop many of the methods now employed in the preparation and manipulation of this interesting and important class of compounds.

With the collaboration of a long succession of assistants and graduate students nearly one hundred and fifty scientific papers were published in the period 1871–1914. Most of these collaborators are now to be found in positions of great responsibility all over the country in both teaching and industry. The importance of his research was early recognized by his election to membership in the National Academy of Sciences in 1883.

Devotion to his work, both teaching and investigation, was the dominant motive of his life, and his interest in the university did not flag in the slightest after his retirement. He was never robust, and the effects of an attack of nervous prostration in 1878, caused by overwork and mental strain, never entirely disappeared. In consequence he adopted a somewhat rigid routine of life which was varied only by necessity. The hours of each day devoted to work were carefully adjusted to the limit of safety, and unnecessary exertion was avoided so far as possible. Fortunately he had the relief afforded by many hobbies. His interest in art dates from study in his youth which, though it convinced him that he had little talent, developed a critical taste which was permanent. Amateur theatricals, at home where he wrote the plays for the benefit of his invalid mother, and in the Cambridge Dramatic Club, were for many years a source of pleasure. Fondness for the solving of problems of all sorts undoubtedly was at the bottom of his keen interest in chemical investigation. Even at eighty-five, when owing to a serious operation in 1928 he had been a semi-invalid for five years, he began an intense study of what he called "The Mysteries of Shakespeare" in order to discover the answers to such questions as: What parts did Shakespeare act in his own plays? Who took the various women's parts?, and he had already prepared for publication two articles on these subjects. In "The Gold Point," published in 1926, are collected a series of fanciful stories originally told to groups around the fireside.

His personal likes and dislikes were pronounced, perhaps not always unaffected by bias, but to his friends he was the soul of loyalty and generosity. Family affection and pride were particularly strong. During most of his life he lived at the family residence, 383 Beacon Street. Summers, however, were always spent at Pride's Crossing, where gardening

became the greatest of his hobbies. His friends will always remember more vividly their visits to his summer home. There, among his flowers, with the sea almost at his doorstep, he was the perfect host, entertaining, witty and sympathetic.

GREGORY P. BAXTER
FRANCIS G. PEABODY
EDWIN H. HALL

RECENT DEATHS

EDGAR SYDENSTRICKER, scientific director of the Milbank Memorial Fund, died on March 19, at the age of fifty-four years.

DR. JAMES MORRIS PAGE, until his recent retirement professor of mathematics and dean of the University of Virginia, died on March 12, at the age of seventy-two years. He had been connected with the University of Virginia for thirty-eight years.

A. H. HOOKER, technical director of the Hooker Electrochemical Company at Niagara Falls, died on March 9, in his seventy-first year.

DR. WILLIAM H. BERGTOLD, formerly professor of pathology at the University of Buffalo and at the University of Denver, also known as an ornithologist, died on March 19 at the age of seventy years.

DR. C. LLOYD MORGAN, professor emeritus in the University of Bristol, who was the first vice-chancellor of the university, died on March 6 at the age of eighty-four years. Dr. Morgan had filled the chair of geology and biology at University College, Bristol, from 1883 to 1887, when he became principal. He was appointed chancellor in 1910. This post he relinquished after a few months and was then appointed to fill the new chair of psychology and ethics. This chair he held until his retirement in 1919.

THE death is announced of Dr. Ettore Marchiafava, senator and professor emeritus of pathologic anatomy at the University of Rome.

PROFESSOR J. P. KHOMENKO, of Leningrad, known for his work on the Cenozoic paleontology and stratigraphy of the USSR, died on August 7, 1935, on an expedition to Sakhalin Island.

SCIENTIFIC EVENTS

THE REORGANIZATION OF THE MEDICAL SCHOOL OF McGILL UNIVERSITY

IT is planned at McGill University to reduce the time required for the courses in medicine from five to four years, without diminishing the actual time spent in the college. According to the official announcement, the new plan provides that

(1) The minimum period of professional training required by the independent practise of medicine shall be five years including, (a) four years of medical study in the university leading to the degree of M.D., C.M., and (b) one year of interneship in an approved hospital or one year of further medical study in the Faculty of Medicine of McGill University or of another medical school approved by it.

(2) A certificate that his medical education is completed and that he is eligible to sit for the examination of a licensing board shall not be issued to any graduate until the university is in possession of satisfactory evidence that he has completed the full requirements.

In a further statement it is pointed out that:

The effect of this action will be to replace the present undergraduate course, which spreads over five academic years of seven and-a-half months each, by a course covering four years, each with a nine-month session and to bring the year of hospital interneship within the five-year period of training which is now required before license in 28 provinces and states and which the faculty believes to be a necessary part of every doctor's education. The new regulation provides that this year shall be spent as an interne in an approved hospital, or in further study in the Faculty of Medicine of McGill University or of another medical school approved by it. It is to be expected that in the majority of cases the postgraduate interne will be chosen, since it is the most direct and most economical pathway to practise. Those who travel this route will be able to accomplish in five years what it now takes six to do and will thus save the cost of tuition, board and lodging for one year.

To those who prefer to devote the fifth year to further study in fields in which they are especially interested, several alternatives are open, since the time may be spent in advanced work along scientific or clinical lines either at McGill or abroad. An opportunity is thus offered to those, for example, who wish to obtain a British qualification and who may spend the graduate year in an English hospital school preparing for the examination of one of the British Licensing Bodies.

With the progress of medical science and an increasing social consciousness of the need for the preservation of health, there is an insistent demand for an even more thorough training than has been required in the past. In its reorganized course the university has aimed at meeting this demand without increasing the long and arduous period of preparation, while actually decreasing the cost to the student.

REPORT OF THE COUNCIL ON PHARMACY AND CHEMISTRY OF THE AMERICAN MEDICAL ASSOCIATION ON THE NEW ERGOT ALKALOID

THE Council of Pharmacy and Chemistry of the American Medical Association has made the following report on the new ergot alkaloid:

During the past year, communications from four laboratories have been published reporting the isolation of a new oxytocic alkaloid from ergot. Until recently there has been doubt as to whether or not the principles reported by these laboratories were identical (termed "Ergotocin" by Kharasch, "Ergometrine" by Dudley and Moir, "Ergobasine" by Stoll and "Ergostetrine" by Thompson). In a jointly signed statement (SCIENCE, February 28) Kharasch, King (acting for Dudley), Stoll and Thompson say there is "no doubt that the alkaloid obtained in the four different laboratories was the same substance. . . ."

It is necessary, therefore, that a suitable *non-proprietary* name which is *not therapeutically suggestive* be adopted for the new alkaloid. Not one of the several names that have been proposed by the discoverers complies with these requirements. The Council on Pharmacy and Chemistry of the American Medical Association, in session March 14, therefore determined to adopt the new, non-proprietary name "Ergonovine" (ergo-nov-ine). The council concedes to the discoverer of a product the right to the use of a proprietary name. It can not, however, accept more than one proprietary name because of the confusion to which such practice gives rise. In the present case several different names have been proposed. It seems impossible to establish undisputed priority. The council has decided therefore that it would recognize no proprietary name.

The *Journal* of the American Medical Association writes editorially as follows:

Last year the isolation of a new alkaloid from ergot was reported within a relatively short period from four different laboratories, two in the United States, one in England and one in Switzerland. The new substance was found in each case to be different in its properties from the previously known alkaloids of ergot; its oxytocic effects were much more prompt and more lasting than those of ergotoxine or ergotamine and the required dosage was smaller. Some discrepancies in the reported physical and chemical properties of the material isolated by the different investigators led to doubt as to the identity of the four products; four names were proposed, ergometrine (Dudley and Moir), ergotocin (Kharasch and Legault), ergobasine (Stoll and Burckhardt) and ergostetrine (Thompson). Owing to the confusion entailed by the doubt as to the identity of the four products so designated, workers in the four laboratories commendably agreed to exchange specimens and to compare the various products. Kharasch, King (acting for the late Dr. Dudley), Stoll and Thompson have now reported that their "comparisons of the melting points and mixed melting points of the four alkaloids and of certain of their salts, and of their optical activities in different solvents in cases where sufficient material was available, leave [them] in no doubt that the material obtained in the four different laboratories was the same substance, and that the four names given to it are synonyms." Elsewhere in this issue the Council on Pharmacy and Chemistry reports the adoption at its annual session on March 14 of a new non-proprietary name for this alkaloid, "ergonovine." This new term was chosen instead of one of those already proposed because of the difficulty of determining priority and because of possible conflict of the other names with the policy of the council governing nomenclature. The agreement among the investigators concerned as to the identity of the alkaloid and the adoption of a single name to replace the four previously in use (and others employed in addition by commercial firms) should now prevent further confusion.

CONSERVATION IN COLORADO

A CONFERENCE was called on February 28 by Governor Johnson, of Colorado, to which were invited authorities on conservation of the federal and state governments to discuss a plan to establish a game refuge in South Park, which would be designed to preserve one of Colorado's natural beauty spots, provide a sanctuary for all types of native game and furnish a playground for the entire United States.

Preliminary plans call for the setting aside of approximately 549,000 acres in the heart of Park County and the addition to it of 851,000 acres now incorporated in the Pike National Forest. Natural conditions in South Park would be restored and the areas stocked with buffalo, elk, deer, beaver and other forms of wildlife.

The area includes South Platte and Arkansas drainage areas on the west, the Continental Divide on the north, Kenosha Pass on the northeast, the Puma and Tarryall Hills on the east and the division between the Platte and Arkansas watersheds on the south and southeast.

Approximately 59 per cent. of the 549,000 acres proposed for the refuge is now privately owned, while the remaining 41 per cent. is owned by the federal, state or county governments. The scenic beauty of the park is unsurpassed, and as a refuge it would remain unspoiled. Although surveys have not been completed, it is estimated the 1,400,000 acres could support at least 60,000 head of big game animals and countless smaller animals. It is believed that the land could be withdrawn, water rights secured and the refuge actually started for approximately two and a half million dollars.

THE SEATTLE MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE twentieth meeting of the Pacific Division, American Association for the Advancement of Science, and associated societies will be held under the auspices of the University of Washington, Seattle, from June 16 to 20. The number of societies proposing to join in this meeting is substantially greater than in that of any previous meeting of the division. The names of the societies with the names and addresses of the persons in charge of the programs follow:

American Association of Economic Entomologists, Pacific Slope Branch, J. F. Lamiman, University of California, Davis, Calif.

American Chemical Society, V. Sivertz, University of Washington.

American Mathematical Society, T. M. Putnam, University of California.

American Meteorological Society, Lawrence C. Fisher, U. S. Weather Bureau, Seattle.

American Physical Society, P. H. Kirkpatrick, Stanford University.

American Phytopathological Society, Pacific Division, B. A. Rudolph, University of California Deciduous Fruit Station, San Jose.

American Society of Ichthyologists and Herpetologists, Western Division, Arthur Svihla, State College of Washington.

American Society of Plant Physiologists, Western Section, H. F. Clements, State College of Washington.

Association of Pacific Coast Geographers, W. B. Merriam, University of Washington.

Astronomical Society of the Pacific, W. E. Harper, Dominion Astrophysical Observatory, Victoria, B. C.

Botanical Society of America, Pacific Section, Geo. B. Rigg, University of Washington.

Cooper Ornithological Club, Leo K. Couch, Old Capitol Building, Olympia, Wash.

Ecological Society of America, Orlando Park, Northwestern University, Evanston, Ill.

Geological Society of America, Cordilleran Section, Charles A. Anderson, University of California.

Oceanographic Society of the Pacific, C. L. Utterback, University of Washington.

Pacific Coast Entomological Society, E. G. Linsley, University of California, Los Angeles.

Pacific Northwest Bird and Mammal Society, Leo K. Couch, Old Capitol Building, Olympia, Wash.

San Francisco Aquarium Society, Mrs. Irwin Kramer, San Francisco.

Society of American Bacteriologists, Northern California, Hawaiian Branch, B. J. Olson, Stanford University.

Society for Experimental Biology and Medicine, Pacific Coast and Southern California Branches, D. M. Greenberg, University of California.

Western Psychological Association, R. C. Tryon, University of California.

Western Society of Naturalists, E. G. Moberg, Scripps Institution of Oceanography, La Jolla.

Western Society of Soil Science, S. C. Vandecaveye, State College of Washington.

Members who plan to attend the meeting and who wish to present papers are advised that titles of their communications, accompanied by brief abstracts, must be in the hands of the secretary or representative, given above, not later than April 27. The complete program will be distributed by mail to members of the association resident in the Pacific and far western states.

Of the evening addresses to be given before the association, one will be by Professor R. C. Tolman, president of the Pacific Division, on "The Present Status of Cosmology." Researches in the field of illumination with rare gases and metallic vapors under electrical stimulation, accompanied by physical demonstrations, will be presented by F. K. Kirsten.

The morning of Tuesday, June 16, will be devoted to a divisional symposium on "Oceanography" with addresses on marine biology, physical oceanography, fisheries and hydrographic survey. The progress of research in selected fields in astronomy, botany, chemistry and paleontology will be presented in a general session on Tuesday afternoon.

SCIENTIFIC NOTES AND NEWS

DR. FRANZ BOAS, since 1899 professor of anthropology at Columbia University, who will be seventy-eight years old on July 9, will retire from active service on June 30.

ON the occasion of the celebration of the seventieth anniversary of engineering at Lafayette College, the doctorate of science was conferred on Dr. Charles Franklin Kettering, president of the General Motors Research Corporation; on Almon H. Fuller, head of the department of civil engineering of the Iowa State College, and on George S. Rice, chief engineer of the U. S. Bureau of Mines.

AT a dinner given on March 17 by the Alumni Association of the Graduate Schools of Columbia University, Dr. Henry C. Sherman, Mitchill professor of chemistry, received a bronze plaque "for outstanding contribution to the human race." Among the scrolls presented was one to Dr. Marston T. Bogert, professor of organic chemistry, as "professor, chemist, lecturer and author," and one to George Clyde Fisher, of the American Museum of Natural History.

THE degree of doctor of laws will be conferred in June by the College of William and Mary on Dr. James Bryant Conant, president of Harvard University.

THE doctorate of science of the University of Cambridge has been conferred on Dr. Ludwig Prandtl, professor of applied mechanics at the University of Göttingen.

THE Samuel D. Gross Prize of the Philadelphia Academy of Surgery has been awarded to Dr. Owen H. Wangensteen, professor of surgery and head of the department of surgery in the Medical School of

the University of Minnesota, in recognition of his work on intestinal obstruction.

DR. RUDOLF STUMMER-TRAUNFELS, professor of zoology at the University of Graz, has received the Linneus Silver Medal of the Swedish Academy of Sciences.

DR. A. C. SEWARD, professor of botany and master of Downing College, University of Cambridge, has been elected to an honorary fellowship at St. John's College.

THE title of "Fellow of University College, London" has been conferred among others on: Dr. Frederick George Donnan, professor of chemistry in the University of London; on Dr. Harold Percival Himsworth, deputy director of the Medical Unit at University College Hospital Medical School; on Dr. Reginald James Ludford, honorary lecturer in cytology at University College, and on Dr. Arthur Salusbury MacNalty, chief medical officer of the Ministry of Health.

A. M. BAILEY, of the Chicago Academy of Sciences, has been appointed director of the Colorado Museum of Natural History, to succeed J. D. Figgins, who resigned last November. Mr. Bailey will go to Denver shortly after the first of May.

ARTHUR J. ROY, who retired in January from the department of meridian astronomy of the Carnegie Institution of Washington, has been appointed research assistant of the institution. He plans to take up the reductions of observations made by the late Albert S. Flint in cooperation with the Dudley Observatory at Albany, N. Y. The work will be carried on at the observatory.

RANSOM A. MOORE, founder of the Wisconsin Agricultural Experiment Association, who has served continuously as its secretary since its organization thirty-five years ago, tendered his resignation to the association at its recent annual meeting. E. D. Holden, assistant secretary, was elected to succeed him.

DR. FRANKLIN C. BING, assistant professor of biochemistry, has been granted a leave of absence from Western Reserve University to assume the secretaryship of the committee on foods of the American Medical Association.

DR. OLIVER L. FASSIG, research associate of the Blue Hill Meteorological Observatory of Harvard University, returned to the School of Tropical Medicine to continue his studies, begun two years ago, on the climate of Puerto Rico.

H. K. HAYES, chief of the division of agronomy and plant genetics of the University of Minnesota, has left for the National Agricultural Research Bureau, Ministry of Industries, Nanking, China, where he will undertake to advise on methods of breeding wheat, rice, cotton, sweet and Irish potatoes and possibly tobacco; to supervise a coordinated program for the whole nation in breeding these crops; to advise on breeding disease-resistant varieties, and to train in methods of plant breeding a selected group of Chinese field workers, most of whom have had graduate training abroad, especially in the United States.

JAMES M. ANDREWS, research associate in anthropology at the Peabody Museum, has returned from a year's study of conditions in Siam. Mr. Andrews's survey was financed by the Siamese government to carry on the study of that country made in 1931 by Professor Carle C. Zimmerman, of Harvard University. Professor Zimmerman, Professor Alfred M. Tozzer, Professor Earnest A. Hooton and the late Professor Roland B. Dixon participated in making plans for the survey.

DR. WARREN H. COLE, assistant professor of surgery at Washington University Medical School, has been named head of the department of surgery at the University of Illinois Medical College in Chicago. He will succeed the late Dr. Carl Hedblom.

DR. NEIL E. GORDON, professor of chemical education at the Johns Hopkins University and director of national fellowships, has resigned to become chairman of the department of chemistry at Central College, Fayette, Mo.

DR. HOWARD H. CUMMINGS has been made assistant director of graduate medical education at the Medical School of the University of Virginia.

DR. HOWARD B. LEWIS, professor of biological chemistry at the Medical School of the University of Michigan, lectured on March 15 before the Yale University Chapter of Sigma Xi at its annual banquet. His address was entitled "The Chemist Looks at Biology."

DR. R. A. EMERSON, head of the department of plant breeding at Cornell University, spoke before the Sigma Xi Club of the University of Florida on March 9 on "The Physical Basis of Heredity." On the afternoon of March 10 he led a symposium on Plant Improvement before a group of agricultural workers. On March 11 he gave the main address at the convocation of the College of Agriculture on "Heredity and Environment."

THE second John Howard Appleton Lecture of Brown University for the year 1935–36 will be delivered on April 6 by Professor Arthur Haas, of the University of Vienna. He will speak on "Fundamental Ideas of Modern Physics."

THE sixth lecture in the Smith-Reed-Russell series for this year at the School of Medicine of the George Washington University was given on March 17 by Dr. Henry E. Sigerist, of the Institute of the History of Medicine at the Johns Hopkins University. The title of his lecture was "The Philosophic Background of Medicine."

PROFESSOR J. H. MATHEWS, chairman of the department of chemistry at the University of Wisconsin, lectured before a joint meeting of the Eastern New York Division of the American Chemical Society and the Rensselaer Chapter of Sigma Xi on March 11 at the Rensselaer Polytechnic Institute. His subject was "The Use of Scientific Methods in the Identification of the Criminal."

AT the two hundred and seventy-first meeting of the Washington Academy of Sciences on March 19 two films were shown: "The Leeuwenhoek Tercentenary Film," presented by Morris C. Leikind, of the Institute of the History of Medicine, at the Johns Hopkins University, and "The Mammalian Egg: Its Ovulation, Fertilization and Development," presented by Everette I. Evans, of the Bureau of Dairy Industry, U. S. Department of Agriculture.

DR. WALTER SCHILLER, of the Woman's Clinic and the University of Vienna, has been appointed Ingleby Lecturer at the University of Birmingham for 1936, in place of Professor Frankl, Vienna, who is unable to go to England because of pressure of work. Professor Arvid Wallgren, physician-in-chief of the Children's Hospital, Gothenburg, Sweden, has been appointed Ingleby Lecturer for 1937.

AT the third International Congress of Comparative Pathology to be held at Athens from April 15 to 18, the United States will be represented on the program of papers by H. B. Humphrey, principal pathologist, U. S. Department of Agriculture; Dr. A. J. Riker, professor of plant pathology, University of Wisconsin; Dr. H. S. Reed and Dr. H. S. Fawcett, professors of plant pathology, Citrus Experiment Station of the University of California, and Dr. E. C. Stakman, professor of plant pathology, University of Minnesota. They will present papers dealing with disease immunity in plants.

THE second preliminary program of the fourth International Congress for Experimental Cytology, which will meet at Copenhagen from August 10 to 15, has been issued. The opening session will take place on the morning of August 10. The afternoon and the four following days are set aside for scientific papers, each day being devoted to a special subject, as follows: "Physical Chemistry of the Soil," "Histochemical Problems and Cell Metabolism," "Experimental Morphology," "Electrophysiology of the Cell," "Experimental Cell Pathology and Biology of Irradiation." Saturday will be devoted to excursions and visits to research institutions. The fee for the congress is twenty Danish crowns. Those desiring to present papers and demonstrations should submit the titles, together with brief summaries, before June 1. The time allotted for each paper should not exceed 15 minutes. The authors are further requested to give exact information on the nature of the material to be demonstrated and the size of lantern slides and cinema films. A definite program will be sent to the members of the congress before July 1. Those planning to attend the congress should notify Dr. Harald Okkels, secretary, Institute for Pathological Anatomy, 11 Frederik 51 Vej, Copenhagen, Denmark, to whom all communications should be addressed.

THE Ohio Academy of Science will hold its forty-sixth annual meeting on April 10 and 11, at the University of Toledo, Ohio, under the presidency of Dr. W. H. Bucher, of the University of Cincinnati. A general meeting will be held on Friday morning for the transaction of business, followed by a scientific session with an address of general interest. Friday afternoon will be devoted to sectional meetings, eight in number. The annual dinner will be given on Friday evening, at which the presidential address will be delivered and distinguished visitors introduced. On Saturday morning a business session for the report of committees, election of officers, etc., will be held, perhaps followed by sectional meetings. The afternoon will be given over to visiting exhibits and demonstrations, sight-seeing tours, etc. Dr. H. H. M. Bowman is chairman of the local committee.

THE Mobile Academy of Science, a local branch of the American Association for the Advancement of Science, closed its first year with the election of officers on March 5. Those elected were: *President,* Rev. Dr. P. H. Yancey, S.J., head of the department of biology in Spring Hill College; *Vice-president,* Dr. Toulmin Gaines, physician; *Secretary,* Matt J. Lawler, professor of science in Murphy High School; *Treasurer,* Dr. A. A. English, lapidarist; *Historian,* Miss Hazel Driver, head of the science department of the Murphy High School; *Members of the Board of Trustees,* Dr. Stephen Hale, physician, and Dr. L. A. Loveridge, head of the department of physics of Spring Hill College. During its first year the academy held bimonthly lectures and field trips in the sciences of biology, chemistry, entomology, geology, medicine, mineralogy and physics. It also undertook the formation of a science museum in the Mobile Public Library. It now has fifty active members and one honorary member, Professor A. H. Sturtevant, of the California

Institute of Technology, who formerly resided in Mobile.

PREPARATIONS are being made to hold the annual conference of the Textile Institute in London in June, when the annual Mather Lecture will be delivered by Dr. Ernest Goulding, of London, who until recently was the fiber expert at the Imperial Institute. His subject will be "Textile Fibers of Vegetable Origin: Forty Years of Investigation at the Imperial Institute." The conference papers will be generally devoted to textile raw materials, dealing with their production and properties. Textile Institute medals have been awarded to J. E. Dalton, the divisional inspector of the Technical Branch of the Board of Education for Lancashire and Yorkshire, and to T. Morley, of Leicester.

THE National Institute of Industrial Psychology has arranged an Easter week-end study school to be held at Exeter College, Oxford, from April 9 to 13. The subject of study will be "Problems of Work and Leisure." Among the speakers will be Dr. A. T. P. Williams, dean of Christ Church, Oxford; Dr. E. K. Le Fleming, chairman of Council of the British Medical Association; E. J. Patterson, head of the Department of Extra-Mural Studies, University College, Exeter; Captain C. R. Coote, and Professor J. H. Jones, professor of economics in the University of Leeds.

THE golden jubilee of the establishment of the first alternating current system in America was celebrated on March 20, under the auspices of the American Institute of Electrical Engineers in forty-eight principal cities throughout the country. The central celebration was held in New York City at a dinner at the Hotel Astor, which was attended by nearly six hundred people. The event commemorated was the lighting, on the night of March 20, 1886, of the village of Great Barrington, Massachusetts, with electric lights supplied from alternating current. The occasion was the first of its kind and demonstrated that alternating current was commercially practicable. Speakers at the dinner were F. A. Merrick, president of the Westinghouse Electric and Manufacturing Company, whose founder, George Westinghouse, backed Stanley in his work; C. W. Appleton, vice-president of the General Electric Company; Gano Dunn, president of the J. G. White Corporation, and Bancroft Gherardi, vice-president of the American Telephone and Telegraph Company. Frank W. Smith, president of the Consolidated Gas Company, was the toastmaster. The first practical transformer was built by a young engineer, William Stanley. At the celebration at Pittsfield, Mass., Cummings C. Chesney, the last surviving associate of Stanley and an honorary vice-president of the General Electric Company, was present. A portrait of Stanley was unveiled and the original Great Barrington experiment was repeated in miniature.

AN Associated Press dispatch reports that Professor Auguste Piccard has ordered a new balloon from the Polish Jablonna factory to ascend to the stratosphere to 30,000 meters (about 98,430 feet). The bag is to have a capacity of 10,000 cubic meters. Professor Piccard, it is said, intends to try the new ascension somewhere in Poland late this summer. He made the first stratosphere flight in 1931, reaching an altitude of 51,775 feet over Germany and Austria. The present record of 72,395 feet was set last November 11 in the United States by Captains Albert W. Stevens and Orvil A. Anderson, of the American Army.

THE board of trustees of the New York Medical College and Flower Hospital has authorized the immediate construction of a new medical college behind the present Flower Fifth Avenue Hospital between 105th and 106th Streets. The new building will be nine stories high and will be along the same lines as the present hospital. The cost will be about $1,000,000. It will extend from 105th to 106th Street and will be 125 feet in depth. The medical college will contain all the latest features in medical college construction. It is planned to accommodate four classes of seventy-four students. There will also be a nurses' training school and room for 200 nurses. It is hoped that the architects' plans will be ready by September and that the building will be ready for occupancy by September, 1937.

DISCUSSION

GLOBIGERINA BEDS AS DEPTH INDICATORS IN THE TERTIARY SEDIMENTS OF FIJI

GLOBIGERINA oozes, composed largely of the shells of pelagic foraminifera, cover very extensive areas in modern seas at depths between 500 and 2,000 fathoms, but under proper conditions similar deposits accumulate in shallower waters.[1] The fact that the Neogene Suva formation of Vitilevu, Fiji, contains beds rich in Globigerinidae has been used to support the idea that at least a part of the formation was deposited in depths of not less than 150 fathoms.

[1] W. H. Twenhofel, "Treatise on Sedimentation," 2d ed., pp. 165–166, 1932.

Since this interpretation is not in complete accord with other types of evidence an alternative explanation is here suggested.

The Suva formation and the conditions under which it was laid down have recently been described in a general report on the island of Vitilevu;[2] this volume includes a section on the smaller foraminifera by Dr. J. A. Cushman. The most recent publications dealing with the formation are a posthumous paper on echinoids by Dr. F. A. Bather[3] and a note on a fossil barnacle by T. H. Withers.[4] These two papers were in press when the general report on the island appeared. The Suva formation in its type area consists mostly of marls ("soapstones") with minor amounts of limestone and conglomerate. Cushman studied samples from two "soapstones" rich in foraminifera. He noted that the material was particularly rich in Lagenidae and this fact, judging from similar Recent faunas from the Philippines, indicated a depth of 100 to 250 fathoms. He also noted the almost complete absence of shallow-water Miliolidae and interpreted this to mean a depth of certainly more than 30 fathoms and in all probability considerably more. He stated that a depth of at least 150 to 250 fathoms seemed a fair estimate. Bather attempted to weigh all types of evidence and concluded that the "soapstones" were probably laid down in water not less than 150 fathoms deep and possibly much deeper. Withers described a fossil barnacle attached to the echinoids described by Bather. He stated that it evidently belongs to a Recent Malayan species which is known to occur at depths in excess of 285 fathoms.

Evidence which seems to oppose the above interpretations is found in the type section of the formation. This section includes a lenticular mass of conglomerate and limestone which is underlain and overlain by typical "soapstones." In the limestone are many heads of reef corals which are still in their original positions of growth. It is known that such corals do not flourish below a depth of 40 fathoms; in fact, so far as I can determine, no living colonies have ever been dredged from a depth greater than 50 fathoms. The coralliferous limestone of the type section grades laterally into foraminiferal limestone. Cushman, who examined a sample of this rock, wrote me[5] that it contained all large foraminifera belonging either to *Operculina* or *Operculinella* and that these indicated a depth of less than 30 fathoms.

[2] H. S. Ladd and collaborators, *Bernice P. Bishop Museum Bull.* 119, May, 1934.

[3] F. A. Bather, *Geol. Soc. Amer. Bull.*, 45: 799–874, Oct., 1934.

[4] T. H. Withers, *Geol. Soc. Amer. Bull.*, 45: 875–876, Oct., 1934.

[5] May 24, 1932.

The evidence detailed thus far may be explained in at least three different ways:

(1) It is possible that the conglomerate and the coralliferous limestone of the type section record a sudden elevation of the sea floor, followed by equally sudden subsidence. This interpretation seems improbable because the area concerned is so very small and because the lenticular mass of conglomerate and limestone in the type section is only one of a number of such masses in the Suva area. The other calcareous masses do not show the reef corals clearly in position of growth, but their fauna and lithology are so similar that it seems probable that all were deposited under similar conditions.

(2) The lenticular mass of the type section may represent a shallow water deposit on a high point of a sea bottom having considerable relief. This possibility is rendered improbable by the fact that over the entire Suva area the beds of "soapstone" are horizontal or show very gentle dips.

(3) A third interpretation takes into account the general distribution of Globigerina beds in the "soapstone" facies of the Suva formation. This facies, though widely distributed over the island, is best developed in the Suva area near the southeast coast. Even in this area only an occasional bed is as rich in Globigerinidae as were the two samples studied by Cushman. Most outcrops of "soapstone" contain but a few foraminifera and many are completely barren. The island lies in the belt of the Southeast Trade Winds and the rich foram beds, therefore, lie to windward. It seems probable that the formation as a whole was laid down in shallow waters—waters which, locally at least, did not exceed 50 fathoms—and that during periods of unusually heavy weather large numbers of pelagic foraminifera were washed in to form an occasional foram-rich layer.

This last explanation does not account for the barnacle described by Withers, but the evidence offered by the reef corals, whose depth range is so definitely limited, seems to outweigh this consideration. It may be that future collecting will extend the range of the barnacle into shallower waters.

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THE OCCURRENCE OF CUPULAE ON LATERAL-LINE ORGANS

A CUPULA similar to the cupula of the crista ampullaris of the vertebrate ear has been observed on the lateral line organs of *Fundulus heteroclitus*. This structure has been studied in living specimens as well as in fixed material.

The organs of Fundulus differ from those of many fish in that, with the exception of a small number in canals on the head, they are exposed on the surface of

the body. These superficial sense organs are circular hillocks projecting slightly above the surface and surrounded by moat-like depressions in the epidermis. They are typical sense-organs with central, pear-shaped sensory hair-cells and more peripheral, non-sensory, supporting cells. The latter possess striated surfaces and show well-marked terminal bars between their tips. Numerous mucous cells are present in and around the moat. On the surface of the organ is the cupula, an elongated cone of gelatinous material.

Live fish were immersed in a dilute solution of methylene blue in tap water over night in order that the sense organs might be more easily located. The cupulae were unstained in these specimens and were seen as projections from the surface of the blue-tinted lateral-line organs. The tip of the cupula, however, often appeared blue, because of the staining of adherent mucus and particles of dirt. The diameter of the cupula is about that of the free surface of the organ. They vary in length, sometimes being as long as they are wide, but more often three or four times their diameter. The shorter cupulae are of the consistency of a stiff jelly and are firmly attached to the summit of the organ. After their tips had been pressed to one side with a needle they quickly returned to a vertical position as if made of an elastic material. The longer ones were less stiff and swayed to and fro with the movements of the water. The material was transparent, but when examined in the fresh condition showed vertical striations throughout its length, *i.e.*, at right angles to the surface of the body. These striations were longer than any of the hairs observed on the lateral sense cells. The source of the cupular material was not definitely determined. The supporting cells gave no evidence of secretory activity, while the sensory cells frequently contained numerous granules. However, it was not possible to relate directly the presence of granules to cupula formation.

The occurrence of this structure was irregular. Many fish showed no cupulae. Frequently they were observed on some organs but were absent from others on the same animal, and in a few cases cupulae were observed on every lateral line organ on the surface of the body. In most instances they were found on animals which had been kept in fresh water for several weeks.

Fixed and stained cupulae were also studied. In most cases there was a small space between the outer surface of the organ and the inner surface of the cupula, as if the latter had shrunken during fixation. In sections at right angles to the surface of the body the longitudinal striations described above were visible, and occasionally delicate cross striations could also be seen. The latter were not as closely or regularly spaced as the longitudinal ones. Due to the shrinkage of the cupula, its normal relation to the tips of the cells could not be determined. In cross sections, *i.e.*, those parallel to the surface of the body, the longitudinal striae were shown to be the boundaries of minute spaces or canals in the cupular material. This is similar to the condition described for the crista ampullaris of the ear by Shambaugh and others.

Both in structural detail and in their characteristic association with a sensory epithelium, the cupula of the lateral-line organs in Fundulus and the cupula of the crista ampullaris are strikingly similar. The implications are obvious, especially in the light of the theory of the phylogenetic derivation of the inner ear from a portion of a primitive lateral-line system, and suggest further that the classical descriptions of the cupula of the ampulla are not entirely products of histological fixation as some recent studies imply.

MARTHA DENNY

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THE LIFE HISTORY OF A POULTRY CESTODE

AN ant, *Tetramorium caespitum* Linné,[1] has been demonstrated as an intermediate host for *Raillietina echinobothrida* (Mégnin, 1880), Railliet, 1921, a tapeworm of common occurrence in poultry. Cysticercoids, which were obtained from ants collected in a poultry yard of the Zoological Division, National Research Center, Beltsville, Maryland, were fed to 3 laboratory-reared chickens. These birds were fed, respectively, 15, 12 and 3 cysticercoids and at necropsy there were recovered, 10, 8 and 2 specimens of *Raillietina echinobothrida*, respectively. Except for these cestodes, both the infected birds and 4 controls were free of helminths. No nodules in the intestinal wall, which are frequently associated with *R. echinobothrida*, were present. One bird passed gravid segments in 19 days after the first feeding of cysticercoids and another passed segments 20 days after the feeding; the third bird was killed before the worms had completed development.

Cysticercoids which were measured as living material, not under a cover slip, were approximately ellipsoidal and varied from 338 μ by 193 μ to 384 μ by 272 μ in size. The larval scolex, enclosed by the cyst walls, was armed with hooks on the rostellum and on the suckers, the hooks being similar to those of the adult worm. Neither the 6 embryonal hooks nor a caudal appendage were observed. The cysticercoids were found in 12 out of 314 specimens of *Tetramorium caespitum* (approximately 4 per cent.) which were collected in the previously mentioned poultry yard

[1] Identified by Dr. W. M. Mann, Smithsonian Institution.

during August, 1935. Cysticercoids were located in the abdomens of the ants; 11 ants contained 1 to 3 cysticercoids and one ant harbored 8. *Tetramorium caespitum* is cosmopolitan in distribution and has such varied feeding and nesting habits that its control may be a difficult problem.

Previously, snails have been considered as intermediate hosts for *R. echinobothrida,* but on a morphological rather than an experimental basis. Direct development also has been reported, but confirmation of this is lacking; however, development involving an intermediate host does not preclude the possibility of a direct development.

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SULFOCYANATE TREATMENT OF MANGE IN GUINEA PIGS

THE problem of controlling mange in my colony of guinea pigs has been difficult for several years, due to the fact that infected dogs have been brought to the school from time to time. Sulfur remedies ("flowers of sulfur," resorcinol, and lard or lard substitute) have been effective in most cases, but they have certain disadvantages: (1) time required for preparation; (2) time required for applying; (3) difficulty of getting the materials in contact with the skin; (4) expense. If the disease had been of long standing so that the animal had lost most of its hair on the sides and hips, it was almost impossible to effect a cure. Such animals often lost weight and finally died.

Lauryl sulfocyanate,[1] the compound being used as an insecticide, was selected as a posisble remedy for the mange. The pure compound was dissolved in cottonseed oil and a 2 per cent. solution was used for the tests. The solution was easy to apply and it proved to be a quick and effective remedy. Because of the cost of the pure compound, a technical preparation, which is being sold under the trade name "Loro,"[2] was also tested for its effect upon the mange. This preparation consists largely of lauryl rhodenate (sulfocyanate), but contains a certain amount of rhodenates of octyl, decyl, myristyl and cetyl alcohols. The "Loro" contains 50 per cent. of the active ingredients, the remainder being an emulsifying and wetting agent which enables one to use it in aqueous solution. A 5 per cent. aqueous solution of this preparation was applied by means of a rubber sponge. This solution also proved to be effective in the control of mange in the guinea pig. It was used on several guinea pigs that had not recovered after several applications of the sulfur preparations and all recovered after two treatments.

If any of the above remedies are applied in cold weather, it is well to keep the animals in warm quarters, since these preparations have a tendency to cause the hair to separate into small bunches, thus allowing the animal to chill easily.

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SCIENTIFIC BOOKS

FARADAY'S DIARY

Faraday's Diary. Edited by THOMAS MARTIN, M.Sc., and published by order of the Managers of the Royal Institution of Great Britain, with a Foreword by Sir William H. Bragg, O.M., K.B.E., F.R.S. G. Bell and Sons, Ltd., London, Vols. VI, VII and Index.

WITH these volumes this important work is completed. The earlier volumes were reviewed in SCIENCE of January 13, 1933, and of August 23, 1935. The volumes are sold only in sets, at the price of twelve guineas the set.

The highest praise can be given to the way in which this great task has been executed. The editor and his assistants, the publishers and the Managers of the Royal Institution deserve the warmest thanks and commendation from the scientific world.

Volume VI opens with the continuation of Faraday's study of magnetic lines of force, which was begun in the previous volume. This concept of lines of force was his most important contribution to physical theory. It directed attention to space or to a medium in space as the seat of the electric or magnetic actions exerted between bodies. When taken up by Maxwell and put into mathematical form it proved to be able to account for most of the phenomena then known and to predict others which were afterwards experimentally verified.

The rest of the volume contains many experiments, mostly on the magnetic properties of bodies. In particular, there are tests of various substances for paramagnetism or diamagnetism, and a study of magnecrystallic action made with a torsion balance. Trials made to discover an action of the magnetic field on the spectrum and the production of electricity by the passage of light through crystals yielded no results.

Volume VII contains a long study of the relations of gold and other metals to light, also an attempt to

[1] Roger Adams, University of Illinois, Urbana, furnished the pure lauryl sulfocyanate.

[2] The Grasselli Chemical Company, Cleveland, supplied the "Loro."

detect the time required for the transmission of magnetic effects through space, and another attempt to find some relation between gravity and electricity. The Diary proper ends with a short study of regelation. The number of the last paragraph is 16041. There have been added a few entries found in scattered manuscript notes which are sufficiently consecutive to be worthy of publication. The most important one of these sets of notes presents the study, with Mr. Bassiot, of the stratified discharge in vacuum tubes. The most interesting one is that with which the record closes, on March 12, 1862, in which Faraday describes his endeavor to find some effect on the lines of the spectrum when the source of the light was in a magnetic field. No effect was perceived. The effect was later discovered by Zeeman, who, in his paper of 1896, mentions Faraday's experiment, and ascribes its failure to the inadequate resources of the period. This experiment is probably the last one tried by Faraday.

The Index is in a separate volume of sixty-four pages. In it the entries are often grouped under general heads, such as Electrostatics, Gravity and Electricity, Magnetism, etc., very much as they are given in Faraday's own index to the "Experimental Researches." An interesting feature is the occasional inclusion of short quotations in Faraday's own words expressing his opinions about the matter which he is investigating.

Even in the years covered by these volumes, in which Faraday's health and memory were failing, he showed on occasion his wonderful rapidity of working. There are days in these years in which the work done compares favorably with that recorded in the days of his prime. He apparently could not work so often, but when he did he worked just as well as ever. That his output in these years contained no startling discoveries may depend on the fact that he had already made all the discoveries of major importance which he could have made with the appliances that he had at his command. At least nothing of any importance was done by experimental methods until after the lapse of over twenty years, when improved methods of obtaining high vacua made possible the work of Crookes, from which the modern development of physics may date its origin.

Nothing like this Diary has ever appeared in the history of science. Generally scientific investigators publish papers in which their discoveries are presented in an orderly fashion and in which only positive results are given. Here we have everything that went through Faraday's mind, and we can see the way in which his thoughts developed and took form in experiment. We see the failures as well as the successes, the trivialities as well as the great achievements. It exhibits his personal qualities, his intellectual honesty, his indefatigable persistence, his modesty and candor better than his papers do and more convincingly than can be done in any biography. It is without parallel as a revelation of the working of a great scientific mind.

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HUMAN ECOLOGY

Human Ecology. By J. W. BEWS. pp. xx + 312. London, Oxford University Press, 1935.

BOOKS which skirt the subject of human ecology are appearing in increasing numbers. They may not bear the title. The expression may be absent from their text. But if an author approaches human history as a problem involving the mutual reactions of mankind with a variant and shifting environment, he is writing human ecology; and the output of these works is abundant. The trouble is they are merely fragmentary considerations of a gigantic whole.

Complete success in such a task requires infinite knowledge. The partial success that can be regarded as a possible goal requires a synthesis of all science. A master of human ecology, therefore, belongs among the minor gods. What we must be satisfied with is an erudite inquirer who approaches the subject in a scientific spirit, but who, of necessity, overemphasizes the genetic, the psychological, the sociological or the physiographical aspects of the situation. We have here an example.

Mr. Bews, principal of the Natal University College, is a distinguished botanist, a student of bionomics, who has set out to apply the methods used in the more limited field in determining why we have become what we are. The reader will find the book instructive, because the author has a real flair for epitomizing the essential facts gleaned from the large, well-selected and up-to-date reference list. He will also find it engaging in parts where the plant lore and the ethnographic lore of Africa are considered, for Mr. Bews has first-hand knowledge of these matters. Whether he will gain any very clear insight into the way ecological factors have affected the trend of human evolution is something else. If he does, he must depend largely upon his own synthesis.

The work is introduced by General Smuts, who, since the success of his biological philosophy of holism or, as we call it in this country, emergent evolution, is as much in demand for introductions as the late president of Harvard was for cut-stone mottoes. Four chapters of background building follow, where man's heredity, his environment and his response to his environment are considered. Then comes a chapter on psychological doctrines. This is succeeded by two chapters on general anthropology and three chapters on the ecology of the wood gatherers, the plant cultivators and the herdsmen. Finally, there is a disser-

tation on the origin and development of social strata within the group and a plea for human ecology as a science.

It must be reiterated that some of these essays are extremely well done. The chapter on ancient man is a gem. But one has the feeling that the book is a series of blocks and not a building. The author appears to have gathered together a group of special libraries and to have abstracted their contents systematically and accurately, but separately. The result might be called "a contribution toward a source-book for students of human ecology." It hardly is a text-book on human ecology. There is an exhibit of warp and woof of various colors, but they are woven into no fabric. The author deserves great credit, nevertheless, for his philosophical approach to the subject as an organic whole.

It is to be hoped that Mr. Bews will write a second book with this one as a basis. One would like to know just what part has been played by genetic variability by meteorological factors, by proximity to sea or low land or forest or mountain, by presence or absence of various plants and animals, by religion and taboo and by a thousand and one other matters, on the development of the various clans of the human race. Doubtless there would be errors of omission, faulty conclusions, incorrect emphases and other forgivable sins committed by any one undertaking such a stupendous task. What of it? It would be an interesting and stimulating adventure. And at least an introduction could be written without much more of an expenditure of time than Mr. Sarton has taken for his history of science.

E. M. EAST

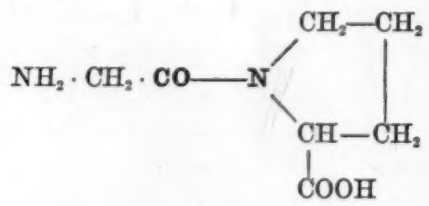
SPECIAL ARTICLES

A NEW TYPE OF ENZYME IN THE INTESTINAL TRACT

THERE are two different types of peptide linkage in proteins. The majority of amino acids possess an α-amino group and are connected with each other in proteins by peptide linkages CO—NH, analogous to the linkage in glycylglycine:

$$NH_2 \cdot CH_2 \cdot \mathbf{CO}\text{——}\mathbf{NH} \cdot CH_2 \cdot COOH$$

However, proline and hydroxyproline have only an α-imino group and are connected with other amino acids by means of a particular type of peptide linkage lacking a peptide hydrogen, analogous to the linkage in glycyl-*l*-proline:



It was found in 1932[1] that peptide linkages of the second type are split by erepsin, but not by pancreatic juice.

It could now be shown that the action of erepsin on substances like glycyl-*l*-proline is due to a special enzyme. In contrast to the principal proteolytic enzymes of erepsin, dipeptidase and aminopeptidase, the new enzyme is not appreciably inhibited by cyanide.

The fact that in some proteins (collagen, gelatin) more than one quarter of the peptide linkages[2] require the action of the new enzyme lends significance to its presence in the intestinal mucosa.

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[1] M. Bergmann, L. Zervas, H. Schleich and F. Leinert, *Zeits. physiol. Chem.*, 212: 72, 1932; M. Bergmann, L. Zervas and H. Schleich, *Ber.*, 65: 1747, 1932.

[2] M. Bergmann, *Jour. Biol. Chem.*, 110: 471, 1935.

THE ALCOHOLIC ADMISSIONS TO BELLEVUE HOSPITAL[1]

DURING the 34-year period of 1902–1935, inclusive, the Psychiatric Division of Bellevue Hospital has recorded 256,755 separate alcoholic admissions. From this average of over 7,500 alcoholic admissions per year a large source of material is available for psychiatric, medical, sociological, economic and public health studies. Data relative to the admissions per annum, the admission rate per capita population, both crude and specific, and the changing proportion of female admissions are recorded in this paper.

The total admissions (Fig. 1) rose from 5,830 in 1902 to a maximum of 11,307 in 1910. In 1911 a downward trend in alcoholic admissions began, and in 1919 7,962 admissions were recorded. War-time prohibition went into effect on July 1, 1919, and the eighteenth amendment became effective on January 17, 1920. In 1920 there occurred a precipitous fall in the number of alcoholic admissions to a low of 2,091, with about the same number of admissions in 1921. From 1922, when there were 4,083 admissions, the trend was upward, reaching 9,542 in 1933, the largest number of admissions since 1910. In 1934, the first

[1] Observations on the admission rate per capita population and the sex distribution, 1902–1935. From the Departments of Medicine and Psychiatry, New York University College of Medicine, and the Psychiatric Medical Service of the Third (New York University) Medical Division of Bellevue Hospital, New York.

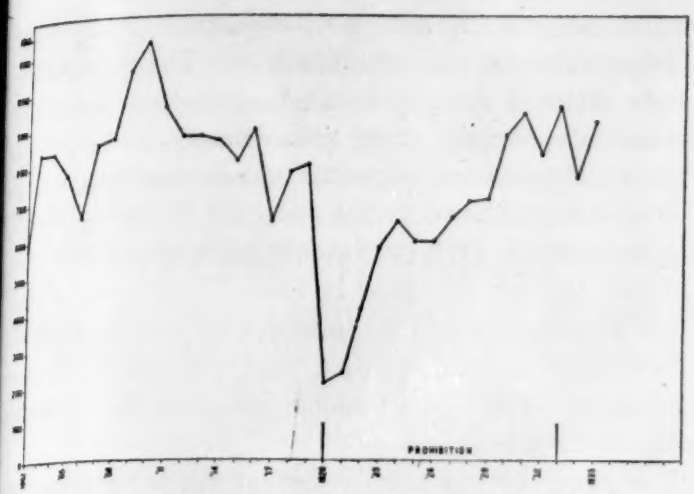

FIG. 1. Total alcoholic admissions, 1902–1935.

full year of repeal, only 7,649 admissions were recorded, but in 1935 there was an increase to 9,139.

The number of admissions in 1935 exceeded slightly the level of the 1902–1911 period. The estimated population of New York City, however, increased from about 3,432,000 in 1902 and 4,845,000 in 1911 to 7,602,000 in 1935. We have therefore calculated the alcoholic admission rate per 1,000 population of New York City (Fig. 2). These figures show a peak of

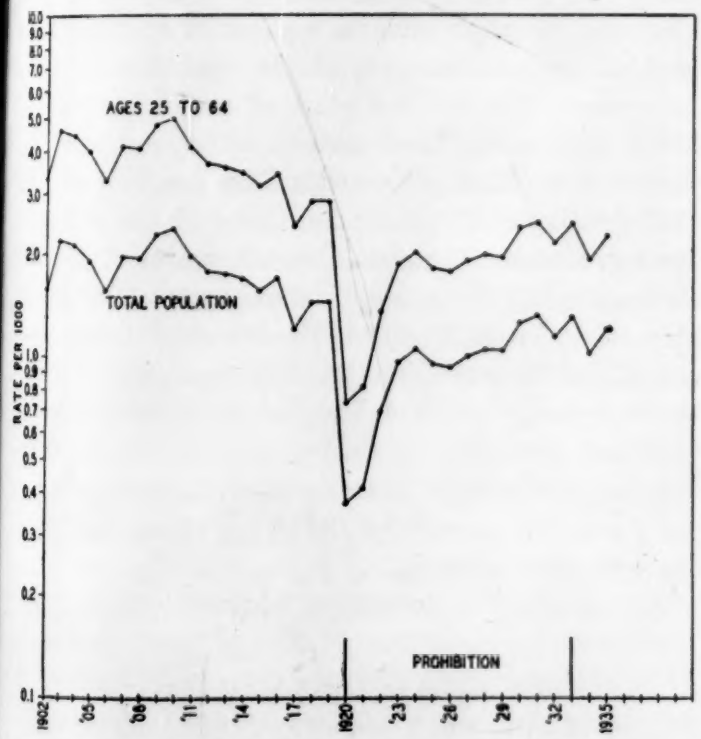

FIG. 2. Alcoholic admission rate per 1,000 total population and per 1,000 population ages 25 to 64, New York City, 1902–1935. Plotted on a semi-logarithmic scale.

2.37 admissions per 1,000 population in 1910, with an average of 1.98 for the ten-year period of 1902–1911. From 1912 to 1919 the admission rate per 1,000 population decreased to 1.44. With the advent of prohibition the admission rates fell to 0.37 and 0.41 in 1920 and 1921, respectively, averaging 19.7 per cent. of the 1902–1911 level. Beginning in 1922 the trend was upward, reaching 1.30 per 1,000 population in 1933. The average admission rate for the last five years of prohibition (1929–1933) was 1.21, which is 61.1 per cent. of the 1902–1911 level. In 1934 and 1935 the admission rate per 1,000 population was 1.02 and 1.20, respectively, which is 51.5 and 60.6 per cent. of the 1902–1911 level.

Since about 95 per cent. of the alcoholic admissions are between the ages of 25 and 64—which age group makes up but 53.1 per cent. of the population of New York City (1930 census)—we have calculated the admission rate per 1,000 population of New York City in this specific age group (Fig. 2). The peak was reached in 1910 with 4.99 alcoholic admissions per 1,000 specific population of New York City, and an average rate of 4.16 during the 1902–1911 period. During the period of 1912 to 1919 there was in general a progressive decline, falling to 2.85 admissions per 1,000 specific population in 1919. During the first two years of prohibition (1920 and 1921) the admission rate per 1,000 specific population was 0.73 and 0.81, which gives averages of 18.5 per cent. of the specific admission rate for the 1902–1911 period and 26.2 per cent. of the preceding five years. Beginning in 1922 the trend was progressively upward, and a rate of 2.44 per 1,000 specific population was reached in 1933. The average admission rate for the last five years of prohibition (1929–1933) was 2.28, which is 54.7 per cent. of the 1902–1911 level. In 1934 and 1935, the first two years of repeal, the admission rate was 1.92 and 2.26, respectively, per 1,000 specific population, which is 46.0 and 54.3 per cent. of the 1902–1911 level, and 84.2 and 99.0 per cent. of the 1929–1933 level. It may be calculated that if the present per capita alcoholic admission rate to Bellevue were as high as the 1902–1911 level we would have admitted 16,800 alcohol addicts in 1935 instead of 9,139.

During the period of this study striking changes in the percentage of female alcoholic admissions have occurred (Figs. 3 and 4). In the ten-year period of 1902–1911 female admissions made up 26.0 per cent. of the total. Following 1912 the trend in the percentage of female admissions was progressively lower, so that in 1933 but 13.5 per cent. were females. This progressive fall in the proportion of female admissions was due to a greater decrease in female than in male admissions (Fig. 3). For instance, the average admission rate of male alcoholics per 1,000 specific male population during the last five years of prohibition was 64.0 per cent. of the 1902–1911 level; the average admission rate of female alcoholics per 1,000 specific female population for the same period was only 31.3 per cent. In 1934 and 1935 the proportion of female admissions rose to 17.9 per cent. of the total for each

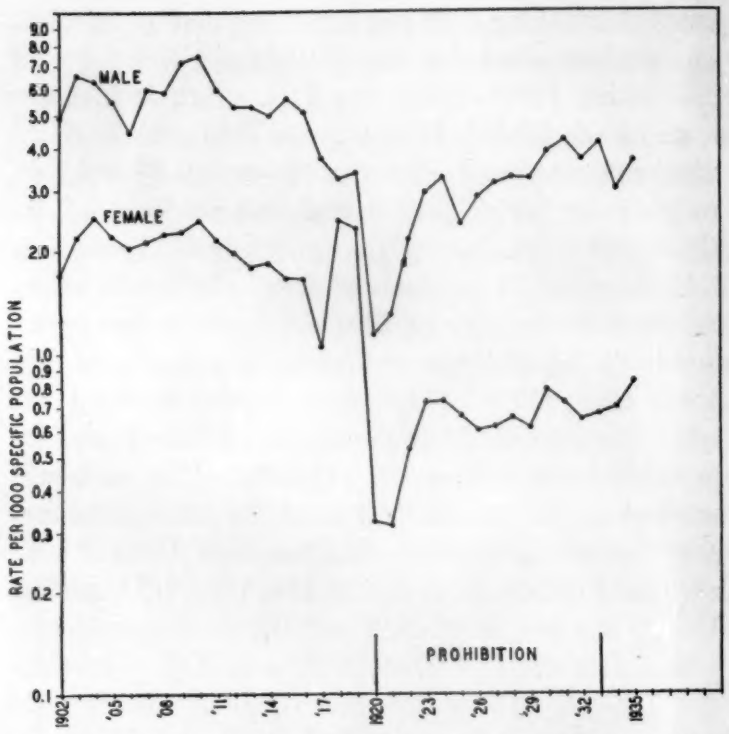

FIG. 3. Specific male and female alcoholic admission rate per 1,000 male and per 1,000 female population, New York City, ages 25 to 64. Plotted on a semi-logarithmic scale.

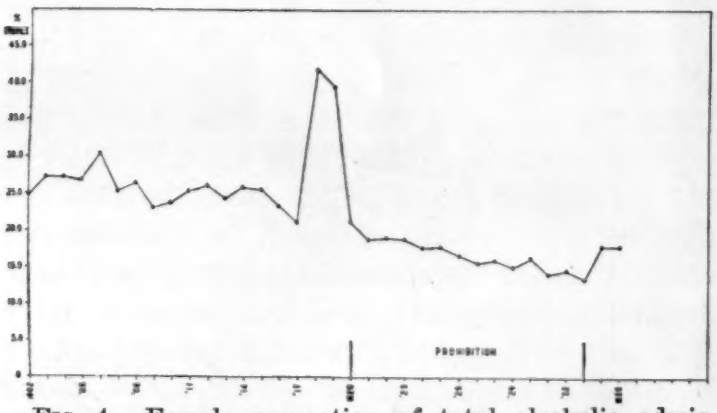

FIG. 4. Female proportion of total alcoholic admissions, 1902–1935.

year. In 1934 this was due primarily to a decrease in the male admissions and in 1935 to an increase in female admissions.

The downward trend in the percentage of female alcoholic admissions was interrupted during the years 1918 and 1919, when 41.8 and 39.5 per cent., respectively, of all alcoholic admissions were females. This increase in the proportion of female admissions was due partly to a lowering of the male admission rate, but chiefly to an increase in the female admissions over 1917 by about 230 per cent.

COMMENT

The highest rate of alcoholic admissions during these 34 years occurred in the 1902–1911 period, when the average admission rate was 4.16 per 1,000 specific population. During the 1912–1919 period there was a definite downward trend in the admission rate. During this period intensive propaganda, consisting of truth, part truth and no truth, was released by certain temperance organizations. These organizations stressed the influence of alcohol on longevity, prosperity, morals, crime and insanity. The success of the temperance organizations in molding public opinion is evidenced by the adoption of the eighteenth amendment in 1919, while only eight states had prohibited the sale of liquor in 1912. It is possible that this propaganda had its influence on many people of New York City, decreasing the incidence of intemperate drinking and thereby lowering the alcoholic admission rate.

Whether or not this is the correct explanation of the 1912–1919 fall in alcoholic admissions, the rate per 1,000 specific population for the five years preceding prohibition (1915–1919) averaged 70.7 per cent. of the 1902–1911 level. The fall in the admission rate per 1,000 specific population to an average of 0.77 for the first two years of prohibition followed precipitously the adoption of the eighteenth amendment, and reduced the admission rate to 26.2 per cent. of the average of the previous five years (1915–1919). The years 1920 and 1921 represent the maximum effect of prohibition on the alcoholic admission rate. On this basis, and by comparison with the 1915–1919 admission rate, we may grade the eighteenth amendment as about 75 per cent. effective in New York City for these two years. The last five years of prohibition (1929-1933) present a different picture. The average admission rate for this period was 77.5 per cent. of the 1915–1919 period. We may therefore on the same basis grade prohibition as about 25 per cent. effective during the last five years of its existence. The admission rates for 1934 and 1935 show no increase over the 1929–1933 level. On this basis prohibition during its last five years was 100 per cent. ineffective in reducing alcoholic admissions to Bellevue Hospital. To predict the trend in alcoholic admissions following repeal on the basis of the 1934–1935 experience would be mere speculation.

The decrease in percentage of female alcoholic admissions from an average of 26.0 per cent. during the 1902–1911 period to 21.4 per cent. in 1920 and 13.5 per cent. in 1933 is progressive and definite, with prohibition apparently not influencing the downward trend. These figures do not support the contention that prohibition and the speakeasy increased inebriety among women. The marked rise in female admissions in 1918 and 1919 may have been due in part to an increase of social drinking occasioned by entertaining soldiers embarking for and returning from overseas. It may, however, be an expression of unhappiness on the part of the women over the war-time absence of a portion of the adult male population. If the latter is true, the mere absence of the men, rather than

worry over the danger to which they were exposed, played the most significant rôle, as the percentage of female admissions was almost as large in 1919, when hostilities had ceased, as in 1918. The rise in female alcoholic admissions to 17.9 per cent. in 1934 and 1935 is too brief an experience from which a significant change in the trend may be predicted.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE USE OF POLARIZED LIGHT IN THE SIMULTANEOUS COMPARISON OF RETINALLY AND CORTICALLY FUSED COLORS

THE importance of the study of the binocular fusion of colors to present theories of color vision makes the phenomenological study of such cortical mixtures a matter of vital interest.[1] The writers have long been interested in the phenomenological comparison of the "cortical yellow" reported by Hecht and the usual, monocularly mixed yellow. Such a study is best carried out under conditions permitting a simultaneous comparison of the colors. The problem of presenting two adjacent stimulus fields, one of which will be presenting red to one eye and green to the other, while the other field is presenting *both* colors to *each* eye, is a difficult one for the laboratory lacking elaborate equipment. The method outlined below is inexpensive, easily set up and adaptable to other visual demonstrations.

Two light sources are used, one containing a red filter, the other a green filter. The light from each of these sources is projected through a polarizing lens upon a directional screen, which maintains the polarization of the light while reflecting it. Aluminized oil cloth makes an excellent screen, although any material covered with aluminum paint will serve. The polarizing lenses are those furnished by the Polaroid Corporation of Boston, and consist of a plain glass lens containing a polarizing material. If the two polarizing lenses are oriented at right angles to each other the directional screen will be reflecting polarized red light oriented in one direction and polarized green light oriented in the opposite direction. To the observer, the screen will appear as a yellow surface. If, however, the observer will place two more polarizing lenses one before each eye (they may be fitted into a spectacle frame for convenience), one oriented to admit the red light but exclude the green, the other to admit the green but exclude the red, the result will be retinal rivalry, since each eye will be stimulated by a different color. Under the correct conditions, cortical fusion will take place and the "cortical yellow" of Hecht will be observed. Preliminary work seems to indicate that this fusion may be helped by reducing the area of the stimulus field. This may be done by surrounding the screen with a black border of variable width.

In order to get simultaneous comparison of cortically and retinally fused colors, one can place a piece of white paper upon the aluminum screen. For small areas white adhesive tape will serve. The light striking this material will not maintain its orientation but will be depolarized and hence neither the red nor green light from this area will be stopped by the polarizing lens worn by the observer. As a result, the screen presents two adjacent fields of stimulation to the eyes, one field supplying red to one eye and green to the other, the other field supplying both red and green to each eye. The observer is thus able to simultaneously observe both retinal and cortical fusion. Intensity values of the two fields may be adjusted by rotating the screen upon a pivot. Since the light is reflected directly ahead from the aluminized portion of the screen, but reflected at all angles from the paper, rotation will cause a relatively greater loss in intensity for the aluminized part as compared with the paper. The same effect may be obtained by varying the angle from which the observer views the screen.

EDWIN H. LAND

LAND-WHEELRIGHT LABORATORIES

WILLIAM A. HUNT

CONNECTICUT COLLEGE FOR WOMEN

[1] S. Hecht, *Proc. Nat. Acad. Sci.*, 14: 237–240.

A PRECISION APPARATUS FOR MIXING GASES IN VARIOUS PROPORTIONS

IN a previous communication[1] we have shown how broken automatic pipettes can be utilized in the construction of some useful laboratory apparatus. The present note describes another appliance of considerable scientific importance also constructed out of two 50 cc automatic pipettes, which were rendered useless because of the breakage of the oval caps, and some other glass apparatus easily obtainable in any laboratory. The recent researches of Blackman,[2] Kidd and West,[3] and Singh[4] on the physiology of higher plants and of Warburg[5] and Keilin[6] on the respiratory enzymes have established that some of the fundamental

[1] Singh and Mathur, SCIENCE, 82: 2139, 626, December 27, 1935.
[2] Blackman, *Proc. Roy. Soc.* (*Lond.*), 103B: 491, 1928.
[3] Kidd and West, *Proc. Roy. Soc.* (*Lond.*), 106B: 93, 1930.
[4] Singh, Malaviya Commemoration Volume (Allahabad), 1932.
[5] Warburg, *Biochem. Zeitschr.*, 177: 471, 1926.
[6] Keilin, *Proc. Roy. Soc.* (*Lond.*), 104B: 206, 1929.

PERIODICAL ROOM

problems connected with the chemistry of respiration and the mechanism of enzyme action can best be solved by a study of oxidative gaseous exchange of plant material under various gaseous mixtures. A precision apparatus for mixing gases in various proportions is therefore needed in all physiological and biochemical laboratories.

The two gases are stored in two gas holders, preferably of the same dimensions, inside which they are maintained throughout at the atmospheric pressure.[7] With the aid of suction applied by means of a single mercury leveling bulb the gases are drawn into two 50 cc pipettes. The same leveling bulb is employed for forcing simultaneously both the gases through a common exit, which results in the formation of a highly satisfactory gas mixture. In the construction of the apparatus, two broken 50 cc automatic pipettes A and B are joined together with two Y-tubes G and H (Fig. 1). The free end of the lower Y-tube is connected

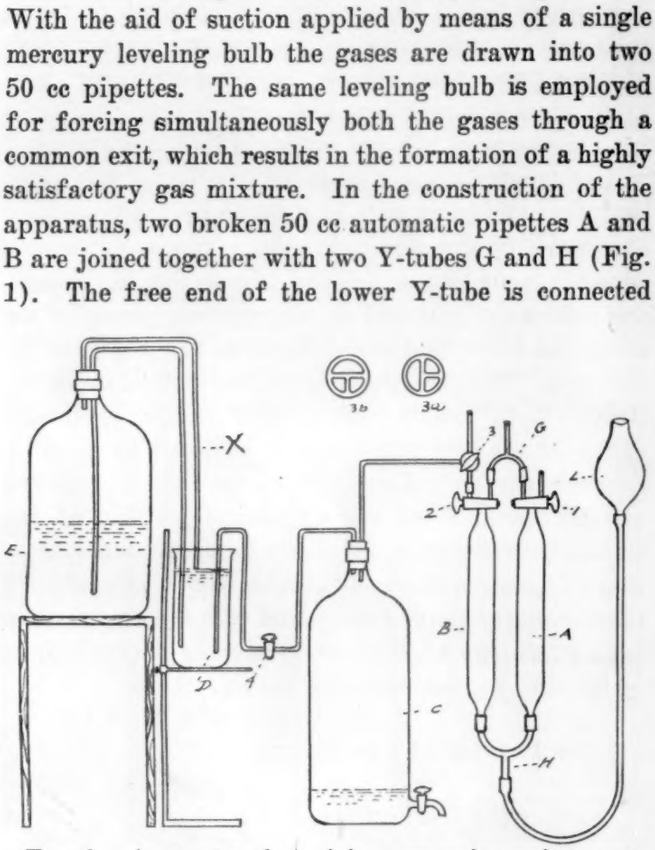

FIG. 1. Apparatus for mixing gases in various proportions.

with a mercury leveling bulb (capacity about 130 cc) through a piece of half-pressure rubber tubing, and that of the upper Y-tube serves as an exit for the gas mixture. The water reservoir E is connected by a siphon to a beaker D, in which the water is maintained at a constant level by means of another twice-bent tube X, which is so placed that the water reservoir E ceases to communicate with the external air the moment the water in the beaker attains a certain level and closes the orifice of the tube X. As a result of this the further draining of water into the beaker is stopped. The beaker D communicates through a glass tubing, which carries a tap as well, with the gas holder C. A three-way stopcock connects the gas holder with the pipette B (Fig. 1). The pipette A is connected to a similar equipment (not shown in the figure) for holding the gas at the atmospheric pressure throughout the experimental period.

[7] Magness and Diehl, *Jour. Agr. Res.*, 27: 1, 1924.

The manipulation is easy. The taps 1 and 2 are turned so that the pipettes communicate with the gas holders. The three-way stopcock 3 is turned in the position 3a and the other stopcock connected with the pipette A (not shown in the figure) is also turned in a similar position. Now the mercury leveling bulb L is raised until the mercury stands just above the stopcock 3, when it should also stand at a similar position in the stopcock connected with the pipette A. Subsequent to this tap 4 is opened and the stopcock 3 is turned in the position 3b and the gases from the two gas holders (one not shown in the figure) are drawn into the pipettes and immediately expelled out of them through the free end of the Y-tube G. This serves to wash the connecting tubes between the gas holders and the pipettes with pure gases. Again the taps 1 and 2 are turned and the gases drawn into the pipettes. The pipettes are once more put in communication with the Y-tube G and as the leveling bulb L is raised a gas mixture issues through the exit which may be directly introduced into the respiration apparatus or stored in a gas holder.

Due to the fact that a double pressure control is exercised—the gases inside the gas holders are maintained at the same pressure and withdrawn therefrom with suction of same magnitude—the results, as tested by means of Haldane's gas-analysis apparatus, are invariably found to be satisfactory. One of the main advantages of this device is that the gas mixtures so prepared need not be analyzed afterwards and may be directly used for experimentation. But it is advisable in all cases to allow the gas mixture directly into the respiration apparatus as the storage of gas mixtures may cause errors due to the different solubilities of the two gases. If two pure gases are used a mixture containing 50 per cent. of each is obtained. This mixture may be stored in one gas holder, while the other may be filled with the pure gas. The mixture obtained under such conditions will be 75 per cent. of one gas and 25 per cent. of the other. By repeating the process a great variety of gas mixtures of varying proportions is easily obtainable.

B. N. SINGH
P. B. MATHUR

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BOOKS RECEIVED

CONANT, JAMES B. *Organic Chemistry: A Brief Introductory Course.* Pp. ix + 293. 27 figures. Macmillan. $2.60.

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